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Nuclear force studies in the proton-deuteron break-up channel at 135 MeV

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A detailed description of nuclear forces is essential for understanding the properties of nuclei and the dynamics in few-nucleon scattering processes. The need for an additional three-nucleon potential became evident when comparing three-body scattering observables and light-nuclei binding energies with state-of-the-art calculations[1].
In this work, the analyzing powers (Ax and Ay) and differential cross sections are presented for the proton-deuteron break-up reaction studied with using a polarized-proton beam at 135 MeV impinging on a liquid-deuterium target. For the experiment we used the Big Instrument for Nuclear-polarization Analysis (BINA) at KVI, the Netherlands. BINA is composed two main parts, a forward wall to detect protons that scatter between 10-35 and a backward ball covering polar angles between 32-160. With this setup, we recently expanded our measurements of cross sections and analyzing powers from earlier presented result [1]. In particular, we measured for the first time A_x for a large range in the kinematical S-curve, polar and azimuthal angles of the two outgoing protons.

Cross section and analyzing power data are compared to predictions from Faddeev calculations that are based on modern two-nucleon and three-nucleon potentials. Our polarization data are reasonably well described by calculations for kinematical configurations at which the three-nucleon force effect is predicted to be small. However, striking discrepancies are observed at specific configurations, in particular in cases when the relative azimuthal angle between the two protons becomes small. The aim is to significantly extend the world' s database in the three-nucleon scattering system as a benchmark to eventually confine the structure of the three-nucleon interaction. In this contribution, some of these configurations along with the analysis techniques will be discussed.

Selected session

Few body systems

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